NEUROSCIENCE-BASED STRATEGIES IN THE ESL ELEMENTARY CLASSROOM

FROM THEORY TO PRACTICE

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Abstract

For years, ESL teachers have been dedicated to planning, organizing, and trying to motivate students to develop their language skills in the target language, but without knowing what occurs in students' brains. Neuroeducation is a new vision of teaching that is based on providing educational strategies focused on brain functioning. This new discipline merges knowledge of neuroscience, psychology, and pedagogy with the aim of optimizing the teaching and learning processes. The present project seeks to develop a better understanding of how to integrate the brain function to the acquisition of a second language and how to manage emotions while learning. In view of above, this project serves as a digital platform to empower educators to apply three neuroscience principles under Guillen (2017) integrated approach (1) neuroscience, understanding how students learn (2) pedagogy, learning how to self-reflect by becoming more metacognitive and (3) psychology, linking emotions to learning. This digital platform contains a set of anchor charts, posters and materials to guide educators in the understanding how to incorporate these three pillars in their instruction. By using the material provided in the digital platform on a daily basis, teachers are building a positive classroom environment, reflecting on their future teaching practices, and ensuring ELLs become life-long learners. Consequently, it can be said that by applying the basic principles of neuroscience, teachers not only understand how the brain functions and learns but also, they provide students with tools to lead their own learning.

Dedication

This thesis project is dedicated to my mother, Marisol Barreto Rozo, my sisters, Luisa Fernanda Garcia and Kelly Johana Garcia, who have offered their unwavering support and encouragement during this journey. Also, to my husband, Pablo Daniel Medina Orjuela, who has always been there for me. You saw all my highs and lows as I worked through the challenges of completing a thesis, and you are always there when I need to talk through ideas and struggles. Thank you for all you do to help me be successful as a student and as a person. To my son Maximiliano Medina Garcia, you are my strength and source of inspiration. And finally, thanks to God for giving me his blessing to achieve the successful completion of this thesis.

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Chapter 1: Introduction

The role of educators in society’s development is essential. For this reason, how instructors perform their instruction in the classroom should be considered crucial to determine the effectiveness of their lessons. Acknowledging the procedures that occur before teaching a lesson is equally important to the experiences that occur while teaching the lesson. Moreover, it is important that educators know how their students learn, and the criteria they use when creating meaningful resources to meet their students' needs in the classroom. Mora (2013) stated that “trying to teach content without knowing how the brain works is like designing a glove without seeing a hand before” (p. 17). Based on Mora's (2013) statement, it is possible to conclude that it is fundamental to guide educators toward neuroscience's world and its potential to assist better learners during the learning process.

Casew and Magnasen (2010) explained that for many years, neuroscientists have been studying how the brain works, how the brain processes the information it receives, and the brain's impact on behavior and cognitive functions. Indeed, neuroscience answers the question of how the human brain learns and provides an opportunity for the educational field to create innovative strategies, materials, and resources to help learners succeed. The partnership between neuroscience and education seems like a perfect match because when asking teachers what makes a lesson difficult or unsuccessful, teachers mention factors related to students’ interests, behavior, and cognitive abilities, which is what neuroscience studies. In addition to the knowledge educators have about brain functioning, neuro-education researchers have shared evidence explaining that the brain's condition can affect the acquisition of knowledge. For example, a sleepy or angry student will struggle to process information and delay making connections, leading to a lack of growth in the student's academic progress.

The benefits of integrating neuroscience techniques in the classroom are unknown to most educators. Educators could benefit their students by effectively applying techniques like.... in the classroom. It is also crucial to recognize that English language learners face multiple challenges when learning a second or foreign language due to emotional factors, such as motivation, self-confidence, and anxiety, which decide the input and output of the second language. Following this idea, it is possible to say that if educators learned about the correlation between the brain, emotions, and the learning process, they would be more qualified to integrate them and provide ESL students with meaningful learning opportunities to develop cognitive and socio-emotional skills.

Learning a second language is not easy. When learning a second language, students experience emotional factors and cultural issues that do not allow them to achieve the learning outcomes. According to Hashemi (2011), learners' perceptions and beliefs about language learning and the linguistic obstacles they encounter while communicating in a second language are strongly linked with language anxiety. Indeed, Horwitz (2008) stated that several studies on second language anxiety have reported the enervating effect anxiety can produce on learning, especially when speaking in a second language. Additionally, Horwitz (2008) highlighted that \ students need to overcome their anxiety to take full advantage of second language instruction.

Considering the previous statements about the importance of using the tools that neuroscience provides to support ESL students in the classroom, this project aims to offer teachers a digital instrument in which they can find concise information they need to understand the theory of neuroscience, the benefits of using it in an ESL classroom, and valuable resources on how to put all these techniques into practice. This digital instrument is composed of three fundamental components:

- First neuroscience, which guides the knowledge of the structure and function of the brain.
- Second, pedagogy as the common notion of learning by answering the question of how students learn and providing corresponding metacognition and self-regulation strategies.
- Third, psychology, which covers the behavioral and mental processes, using emotional intelligence as its base.

Additionally, acknowledging how much teachers can learn from the experiences of other colleagues, the digital instrument encourages educators to participate in discussions and express their opinions about specific topics and case studies, enabling them to enrich their teaching practices.

This project is based on the research of Howards-Jones (2009), Mora (2013), Guillen (2017), and Daniel Siegel (2011), who have studied the cognitive science of learning and its valuable contribution to the educational field. This approach is vital now that teachers are challenged to face different social, emotional, and cultural trends in the classroom. Throughout the development of this project, teachers will benefit in three ways. First, teachers will find the key to empowering their students to be more successful when learning a second language. Second, they will be able to apply some emotional strategies to improve their classroom management by developing a better understanding of students' behavior. Third, teachers will know how to build effective student and teacher communication.

Research in neuroscience indicates that when students are taught how to learn and think independently, they can achieve better academic performance at higher academic levels, as Mora (2013) emphasized in his book *Neuroscience and Education*. The objective of this project is further motivated by the studies that showed the importance of integrating neuroscience techniques in an ESL classroom. As an international teacher, I believe that educators who are constantly driving their teaching practices by applying mindsight activities in their classroom promote a high increase of motivation in students, improving attention levels and performance on a task. As a result, second language acquisition becomes more enjoyable and easier to learn. Additionally, mindsight activities build a positive environment and decrease the levels of frustration and anxiety while learning.

Research has served as the basis for the final product, the digital instrument enabling teachers to bring a neuro perspective into their classroom. As Siegel and Brysol (2011) described in their book The Whole-Brain Child, the knowledge of how a child's brain is wired can lead to a more successful individual on both a personal and academic level.

Chapter 2: Literature Review

The present research considers new advances in neuroscience and their practical application in the classroom setting. A deeper understanding of neuroscience will require exploring the existing research under the perspectives of neuroscience, pedagogy, and psychology. In this chapter, different literature reviews from neuroscience are used to discuss how the brain functions when learning a second language. This is followed by pedagogical research, which examines what metacognition is, how it supports and improves learning and the benefits of its application. Finally, an overview of research on the influence of emotions on learning and its effects in the classroom will be included. This chapter offers a complete view of the different aspects that need to be considered to meet English language learners' emotional, social, and physical needs (ELLs). It helps to recognize what needs to ensure learners’ success in language learning.

What is neuroscience?

Mora (2013) defined neuroscience as studying the human nervous system, which focuses on the brain and how it influences cognitive functions and behavior (p. 12). Neuroscience provides information about the human organ in charge of processing data, which is relevant in education. As the neuroscientist Manfred Spitzer (2006) has indicated, neuroscience will be to education what biology has been to medicine. Guillen (2017) proposed an integrated approach to improve teaching and learning outcomes using basic scientific knowledge about brain functioning (p. 11). Well-known neurologists such as Blakemore (2005), Ansari (2011), and Howard-Jones (2014) have agreed to name this approach the starting point of neuroeducation.

The following graphic provides a clear view of the three components that are the basis of this project, following the point of view of Gillen (2017).

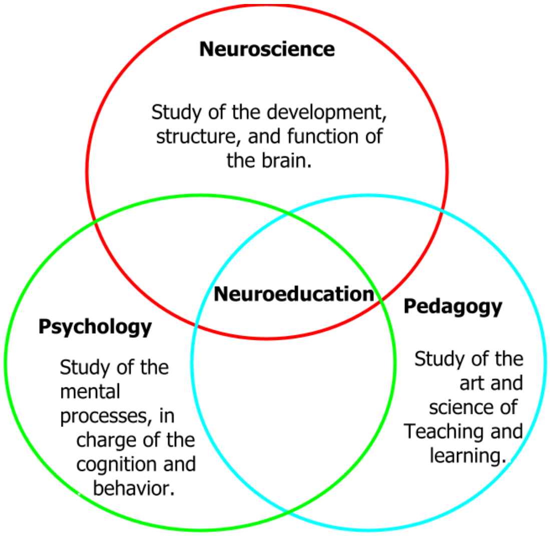
Neuroscience
Study of the development, structure, and function of the brain.
Neuroeducation
Psychology
Study of the mental processes, in charge of the cognition and behavior.
Pedagogy
Study of the art and science of Teaching and learning.

Figure 1. Illustration showing the integrated and transdisciplinary approach proposed by Gillen (2017). Resource adapted from Neuroeducation in the classroom (p. 12).

Component 1: Neuroscience:

The neuroscience component serves as the basis for this project. First, it is essential to emphasize that neuroscience is a cognitive science that focuses on understanding how the brain learns and how this information can be used to develop more effective teaching methods (Marzano, 2007, p. 29). Gillen (2017) stated that knowing how the brain operates could facilitate teaching and learning (p. 17). However, according to the Society for Neuroscience (2009), neuroeducation is still developing new strategies and methodologies to optimize learning. This part of the project mainly focuses on brain function and memory theory.

The brain and its functions.

According to Herculano-Houzel (2012), the human brain is a complex organ of 1.4 kilograms, approximately two percent of the body's weight (p. 11). Similarly, Magistretti and Allaman (2015) explained that even when the brain represents approximately just two percent of the whole-body weight, it significantly consumes energy to carry out complex and constant daily tasks. Herculano and Houzel (2012) asserted that the human brain contains 86 million neurons that can establish ten thousand neuronal connections called synapses. The information sent from one neuron to another during synapsis allows the brain to connect with different body organs to perform specific tasks.

In the same way, a study conducted by Geake (2008) concluded that the primary function of the brain is to process the information it receives through the senses and establishes connections based on the stimuli received (p. 18). Bourgognon, and Cavanagh (2020), supported this idea, and explained that the learning process begins with sensory signals being transcribed in the cortex and then transmitted to the hippocampus, a place in the brain where new memories are believed to form. They indicated that when a signal is strong or repeated, long-term memory is established. To understand the relationship between brain functioning and learning, Geake (2008) also described how the basis of learning relies on these connections by releasing chemical substances called neurotransmitters (p. 20). Based on Geake's (2008) conclusions, the optional functioning of these neurotransmitters has enormous implications in the classroom (p. 22). Likewise, Bairy and Kumar (2019) described how when someone is engaged, the release of substances, such as dopamine, increases the chances of storing the information received in long-term memory. Following this idea, Herculano-Houzel (2012) indicated that teachers need to be knowledgeable about the function of neurotransmitters to be more effective in the classroom.

Memory theory and learning.

According to Marshall (1998), there are three major theories on memory: *the multi-store model, the level of processing theory, and the modular memory theory.* The first component focuses only on the multi-store model of memory proposed by Richard Atkinson and Richard Shiffrin in 1968. According to this model, the brain can store information for short or long periods, depending on how valuable and meaningful the information is. Atkinson and Shiffrin (1971) explained that the human brain initially experiences stimulus via sensory memory. However, despite using the senses, only the relevant information is passed from sensory memory to short-term memory. To keep the information active, it needs to be analyzed, criticized, or rehearsed, intentionally or unintentionally, then it can pass into long-term memory. As Bellec et al. (2018) included adapting neurons drastically increases the computing and learning capability of recurrent networks of spiking neurons (RSNNs) if they are trained and configured by deep learning, optimizing data retention.

Psychologists and neuroscientists, such as Daniel Willingham (2009) and Julie Dirksen (2015), used the multi-store model as an extensive subject for further analysis concerning second language learning. Firstly, Dirksen (2015) explained that sensory memory is the first filter of everything humans feel and perceive. According to Dirksen (2015), anything a person feels is held momentarily, but most sensations pass unless something unusual or noteworthy about what has been perceived (p. 83). Secondly, Dirksen (2015) defined short-term memory (STM) or working memory as the memory that allows someone to hold on to ideas or thoughts long enough to take action (p. 84). Also, Willingham (2009) asserted that short-term memory could store up to seven items. Most of the seven are removed from short-term memory, but some items are encoded into long-term memory (p. 86). Third, Dirksen (2015) described long-term memory (LTM) as the "closet," where information is stored and kept for an extended period. The key to long-term memory is retrieving that information later; thus, knowing in which part of the "closet" shelf or drawer that piece of information is filed away is important (p. 92).

According to Ericsson and Kintsch (1995), Long-term memory is associated with high skilled activities. As a consequence of how information can be retained in LTM, Willingham (2009) highlighted in his book, *Why Do not Students Like School*, that adequate instructions should be delivered with a student's cognitive load in mind, suggesting that learners can absorb and retain information effectively only if it is provided in such a way that it does not overload their mental capacity, meaning it should be conveyed by chunks that allows them to process the information and stay engaged (p. 97).

Component 2: Pedagogy

The second component of this project is pedagogy, and it is essential to clarify that this broad and relevant concept is part of this research from a metacognitive perspective. According to Dehaene (2020), from the field of cognitive science, learning does not occur passively through simple exposure; on the contrary, studies using magnetic resonance imaging (MRI) has shown that the brain is an ever-alert organ that learns by testing the models it projects onto the outside world (p. 238). Understanding how scientific studies benefit the knowledge about how the human brain learns, it can be said that metacognition is not only an effective tool for students to self-assess and reflect in their educational practice, but also has a positive effect in the classroom environment. A clear example is how mistakes are considered learning opportunities (Dweck, 2006, p. 33). Moreover, Schultz (2012) stated that metacognitive practices allow for an active, social, self-directed, context-based, and situated development of the learners' knowledge and skills based on real-world inquiry and problem-based learning environments.

Understanding pedagogy from a metacognitive perspective.

Although metacognition has been defined in different ways by several researchers who have worked in the field of cognitive psychology, the original definition by John Flavell (1979) stands at the forefront. The term metacognition was created by Flavell (1979) in the late 1970s to mean “cognition about cognitive phenomena” or, more simply, “thinking about thinking” (p. 69). Acknowledging the importance of metacognition in regulating and supporting students’ learning process, educational neuroscientists and psychologists have promoted its use in the classroom. Moreover, Brown (1997) stated that using metacognitive strategies in the classroom supports students and helps them to be aware of their learning skills by encouraging them to identify their strengths and weaknesses, allowing students to learn more effectively and purposefully.

Research by Pintrich and Zusho (2002) also has shown that students with a greater personal interest in a topic and those who view an activity as necessary or valuable are more likely to use adaptive self-regulatory strategies allowing them to improve their academic performance considerably as well as the retention of information in the LTM. Besides, according to Brown (1997), young children base their knowledge on concrete experiences, which means they do not use strategies such as planning their work or monitoring their problem-solving skills. In other words, they do not realize they can use strategies and shortcuts to help them solve problems. A research study by Wellman et al. (1975) has indicated these capabilities with three-year-old children, who were asked to remember which cup a toy was placed under. Children spontaneously use several strategies to help them think and remember, indicating that even very young children can be purposeful in these activities (Wellman et al. 1975). Based on that data, Brown (1997), Bransford (2000), and Cocking (2000) acknowledged that the more children learn about general metacognition strategies for learning, the better they will become at using them across language domains.

In their book, *Teaching Students How to Drive their Brains*, Wilson and Conyers (2016) used cognitive assets to convey that metacognitive abilities are valuable and can be enhanced with practice and regular use. They emphasized that students must learn how to use metacognition to know how and when to use these cognitive assets to successfully master learning and problem-solving challenges, both inside and outside the classroom, and to assess how well these strategies are being used. In other words, teaching students to use more metacognitive strategies provides them with the skills to “drive their brains” and become self-directed learners (Wilson & Conyers, 2016, p. 14).

Developing metacognitive competencies in the classroom.

A report by the National Research Council, *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century* (Pellegrino & Hilton, 2012), defined metacognitive domains as one of the most critical competencies to be developed in the 21st-century classroom. Furthermore, following this idea, educators should design and teach their lessons with the learning brain in mind (Willingham, 2009, p. 34). However, it has been shown that even with the wealth of research on the importance of teaching metacognition, teaching practices in countries such as the United States continue to focus on content knowledge (Hartman, 2010, p. 19). For example, a study on lessons taught in multiple elementary classrooms found that, on average, fifth graders received 500 percent more instruction on basic skills than on metacognition and higher-order thinking skills; the ratio for first and third-grade was 10:1 (Pianta et al. 2007). These findings are incredibly discouraging, considering metacognition is at the heart of learning (Wilson & Conyers, 2016). As Ellado (2021) mentioned, a result like this may be attributed to the possession of conceptual knowledge over procedural knowledge, which is critical to creativity. In order to correct this, teachers and administrators should investigate opportunities to provide activities that elevate students' scientific inquiry skills to acceptable standards. This can be done by looking into the curriculum, redesigning specific teaching, and learning activities that focus on integrating these skills into most learning competencies.

In 1995, The Educational Psychology Committee of the American Psychological Association defined learning as the creation of meaningful representations of knowledge through internally mediated processes, including self-awareness, self-questioning, self-monitoring, and self-regulation. In the same way, Nava (2018) stated that metacognitive tools support academic thinking and help regulate social-emotional learning. Metacognitive tools can be used to support clear expectations and as a mentoring device, strengthening resilience-informed practices. For this reason, developing metacognitive competences in the classroom can help students to acquire the skills needed to succeed as learners in the 21st century. In a meta-analysis of 91 studies, Wang et al. (1933) concluded that metacognition is the number one shared characteristic of high academic achievements. Additionally, a study provided by Hattie (2009) found that 80 percent of elementary students in a public school in New York showed a significant academic improvement when they were exposed to metacognitive domains when learning. Moreover, a 2014 study by Veenman and colleagues suggested that the ability to employ a metacognitive approach to learning may account for some 40 percent of the variation in academic achievement across various outcomes.

In 2011, another study by Emily R. Lai supported the effectiveness of specific training on metacognitive strategies in conjunction with math lessons. In this study, a group of middle school students was trained to use metacognitive strategies and compared with a controlled group that did not receive the same instruction. The first group outperformed their peers in their ability to successfully explain math concepts, interpret graphs, and reason, as well as transfer math knowledge to other applications. These positive outcomes are highlighted and reinforced by Wilson and Conyers (2016), who emphasized that students who accomplish academic achievements have been taught to use metacognitive strategies and consequently think effectively and independently and do not depend on their teachers to begin a learning task and monitor progress. Likewise, current research demonstrates how developing metacognitive competences in the classroom benefits individual learners and helps to promote a more positive learning environment (Fleming, 2014, p. 34).

Furthermore, as Pellegrino and Hilton (2012) stated, "Sustained instruction and effort are necessary to develop expertise in problem-solving ad metacognition; there is no simple way to achieve competence without time, effort, motivation, and informative feedback." (p. 10).

Metacognition and the benefits for learners.

According to Schraw et al. (2006), Self-regulated learning refers to the ability to understand and control the one-self-learning environment. For this to happen, learners must set objectives, select strategies to help them achieve them, implement them, and monitor their progress toward the objectives set (Schunk, 1996). Also, Wilson and Conyers (2016) stated in their book, *Teaching Students to Drive Their Brains,* that teachers can provide students with metacognitive strategies that they can adopt to have a more practical and optimistic attitude toward learning. Likewise, McGuire (2015) stated that metacognition follows Bloom's taxonomy. McGuire (2015) added that this is a critical point because it allows learners and educators to understand the hierarchy of cognitive skills that incorporates every individual's unique levels of learning.

There are multiple ways students and teachers benefit when using metacognitive strategies when teaching and learning. Winne and Azevedo (2014) indicated that encouraging learners to develop metacognitive strategies encourages them to be active participants in the classroom rather than passive recipients of instruction, increasing motivation and decreasing failure (p. 63). As a result, students take a more active role in their learning. Willingham (2009) pointed out that using metacognition daily allows students to display their talents and express their abilities by using cognitive knowledge and cognitive regulation to direct and reflect learning. According to Wilson and Conyers (2016), to see the benefits of implementing metacognitive strategies in the classroom, students need to monitor their progress to control their learning better and recognize what strategies help them to become better learners.

Furthermore, metacognitive strategies also help students to recognize mistakes as positive opportunities to learn from and create a positive, optimistic, less stressed, and more practiced mindset (McGuire, 2015). Besides, students are better able to pay attention and engage with a lesson. As a result of higher engagement, students learn and retain more information (Wilson & Conyers, 2016). A study implemented by Veenman et al. (2004) examined the relationship between metacognition, intelligence, and development in students of different ages using metacognition on complex, computer-based inductive learning tasks. This study showed that students’ use of metacognitive skills increased with age and contributed positively to task performance. Veenman et al. (2004) concluded that students been instructed in metacognitive knowledge and skills had shown significant progress in their metacognitive abilities and academic achievement.

As students and more knowledgeable of their strengths and weaknesses, they can apply metacognitive strategies to grow their mindset (Dweck, 2006). Also, Dweck (2006) indicated that through time students can change their strategies to respond to new objectives. In addition, Wilson and Conyers (2016) concluded in their book, *Teaching Students to Drive Their Brains*, that by employing these strategies or cognitive tools, students can continue to improve their learning strengths, purposefully identify and strive to overcome weaknesses as they drive their brains to successful outcomes in school, as well as in their pursuits, and in their future careers.

Component 3: Psychology

John Dewey (1897), an educational theorist from the 1800s, stated, "Education must begin with a psychological insight into the child's capacities, interests, and habits” (p. 211). Dewey (1925) also noted, "Interests are the sign and symptoms of growing power” (p. 322). From a psychological perspective, learning occurs as a consequence of an experience that results in a change in thought or behavior, meaning that if a change in thought or behavior occurs, it can be said that learning has occurred. Therefore, it is essential to emphasize the relevance of integrating the acquisition of a second language within the emotional field. Hence Guillen (2017) stated that it is necessary to learn how to integrate the cognitive and emotional parts of the brain to facilitate learning. As Ushioda (2010) asserted, motivation plays a significant role in learning and teaching the language (p. 20).

Integrating the cognitive part of the brain with emotions.

Emotions are short-lived feelings that help people adapt to the opportunities and challenges they face during important life events (Reeve, 2005, p. 294). Therefore, an emotionally safe environment plays a significant role in the brain's level of functioning during any learning activity (Sylwester, 2001). Chapman and King (2012) stated that if an individual has unpleasant memories or experiences related to a topic, subject, teacher, or classroom design, these initial feelings negatively affect the learning process. However, if a student has pleasant, interesting learning adventures, the mind becomes an open vessel for new learning (Chapman & King, 2012, p. 90).

Rubia (2003) used a Magnetic Resonance Image (MRI) machine to examine the intensified brain activity of elementary students in Ohio who were involved in emotional situations during a lesson. Rubia (2003) discovered that students were more eager to learn by fostering a safe emotional environment (p. 351). He explained that the circuits that regulate emotions are highly interactive with the circuits associated with the brain's executive functions (Rubia, 2003, p. 353). Through these observations and the MRI results, Rubia (2003) concluded that students who are taught how to identify, control, and deal with emotions could be more successful, especially when learning a second language (Rubia, 2003, p. 358). Additionally, Sylwester (2001) explained that this is possible due to the amount of stimulation; thus, the amount of positive stimulation is related to increased intelligence. Sylwester (2011) also stated that healthy emotional experiences are at least as necessary as learning experiences in building healthy brains.

According to Mora (2013), emotions are the main ingredient for teachers to be able to teach and for students to learn. Moreover, Gillen (2017) stated that curiosity is tool teachers and instructors can use to raise students' interest. This interest is connected to one or more emotions that allow the brain to open attention windows, leading to more effective learning; thus, students are paying attention and retaining information. Likewise, LeDoux (2000) suggested a model to identify the strong connection between the emotional brain and the prefrontal cortex (PFC) and demonstrated a strong performance towards learning. LeDoux (2000) found that cerebral structures in the limbic system participate in developing cognitive functions. Consequently, the mind is not just cognitive or emotional but interacts both cognitively and emotionally (LeDoux, 2000, p. 87).

This theory is supported by early research evidence collected by neuroscientists who used MRI, and this research allowed neuroscientists to see that emotions and cognition are intimately connected (Sylwester, 2001). Moreover, a study by the National Academy of Science (2000) determined that if students learn to connect emotions with cognition effectively, they can develop autonomous learning skills. As a result, learning can be more enjoyable.

Fostering a positive environment in the ESL classroom.

According to Gullien (2017), five basic emotions are essential for human survival: sadness, joy, fear, disgust, and anger. These emotions drive students' attention, help to determine meaningful experiences, give place to behavioral expressions, and organize the world according to personal experiences (Cozolino, 2008, p. 65). A study by Durlack et al. (2011) showed the connection between emotion and learning. The students at the 213 schools received instruction in social and emotional learning and showed more developed social-emotional skills. These students could get along with others, manage their emotions, resolve conflicts, have empathy, and display a better attitude toward school and learning (Durlack et al., 2011). Additionally, learners had fewer problem behaviors than students who did not have SEL programs and practices (Durlack et al., 2011). Moreover, students who participated in these programs and practices increased 11 percentile points in their academic achievement (Durlack et al., 2011).

Emotions and cognition are a duo that cannot be separated. Different emotions activate different parts of the brain (Guillen, 2017). In his book, *Neuroeducation in the Classroom From Theory to Practice,* Guillen (2017) explained that negative emotions activate the amygdala and trigger fear-related behaviors. However, when there are positive emotions, the hippocampus, a critical region for memory and learning processes, is activated, allowing students to consolidate the information better. Additionally, Hammond (2015) indicated in her book *Culturally Responsive Teaching and the Brain* that the social-emotional part of the brain is not separated from the cognitive part of the brain but that these two work as a learning partnership and it is the instructor's responsibility to offer an environment that invites students to have positive emotions so that they can feel more comfortable learning and can thrive academically.

According to Hammond (2015), in terms of the emotions that ELLs experience, the brain does not produce enough oxytocin even when the environment is not hostile but simply unwelcoming(p. 45). Anxiety or stress can lead to emotions such as fear which prevent students from fully understanding what is being asked and can also inhibit their ability to read a prompt that has been given. Additionally, Hammond (2015) stated that anxiety could be amplified when students experience feelings of marginalization due to a lack of support. Moreover, Guillen (2017) explained that when anxiety levels are high, students have challenges controlling their impulses. Accordingly, Sapolsky (2015) indicated that stress at high levels affects learning directly, hampering the acquisition of a second language.

A positive environment in the classroom is something that can impact students as well as teachers. Guillen (2017) highlighted that situations that are detrimental to learning could occur both in students and teachers. It has been demonstrated that teachers' stress, sometimes called "burnout," causes a negative emotional contagion that increases students' cortisol levels (Oberle & Schonert-Reichl, 2016). When teachers do not respond or respond weakly to students' needs, students' academic achievement and behavior can be affected (Schonert-Reichl, 2017). Conversely, Schonert-Reichl (2017) stated that classrooms with warm teacher-child relationships support deep learning and positive social and emotional development among students. Therefore, when planning a lesson or any activity requiring student involvement, using emotional management strategies helps to overcome difficulties.

Conclusion

Teachers in 21st-century classrooms face different challenges. First, teachers must support students in acquiring the skills required to thrive academically. Moreover second, teachers must guide students to deal with social and emotional issues successfully. Guillen (2017) explained that neuroeducation is a transdisciplinary approach, and that is where the three components of this project converge as it focuses on improving the teaching and learning processes based on the information obtained about brain functioning. The expectation is that teachers will use neuroscience to support their teaching practice and to understand better why the strategies proposed in this scientific field can be effective when integrated with pedagogy and psychology. The benefits of applying neuroscience in the classroom will accrue through careful planning related to these three components. The result will be students' academic growth and more positive student attitudes toward learning, especially in ELLs. As Mora (2013) stated, "enhancing learning through the power of controlling emotions in the classroom is the most effective way to promote meaningful learning" (p. 39).

Chapter 3: Project Design

In this chapter, I will explain the need of creating a website for ESL elementary teachers to support ELLs based on the advances on neuroeducation and the use of metacognitive strategies to boost learning in the classroom. As Samson and Collins (2012) asserted "Currently, at the various stages of teacher preparation, certification, and evaluation, there is insufficient information on what teachers should know about teaching ELLs" (p. 8). This project focuses on empowering teachers of a number of factors. First, the synergy of understanding the brain plasticity and second, understanding this is a powerful way to increase perceptions of potential and expectations. As Wilson and Conyers (2016) asserted teaching students to be more metacognitive equips them with skills to "drive their brains" and develop self-directed learning skills (p. 94). The expectation of this project is that teachers can learn about mindfulness, growth mindset, and metacognitive strategies to apply practical and motivational approaches for helping all students to become better thinkers.

Consequently, the content of this website may be suitable for ESL teachers as it explains from a neuroscientific, pedagogical, and psychological perspective the different challenges ELLs go through when acquiring this second language. As well as it provides a toolkit for teachers to use different strategies to support students and help them to:

- Adopt a more practical and optimistic attitude towards learning
- Focus their attention
- Monitor their own learning process

- Optimize working memory
- Finish learning tasks
- Learn from experience.

After a global pandemic the socio-economic situations in several countries around the world pushed people to come to the United States seeking a better future. Therefore, this immigration process has implied that ELLs bring to the classroom a “variety of cultural backgrounds, language proficiencies, academic experiences, and cognitive processes" (Perez & Holmes 2010, p. 41). As a result, ESL teachers are facing several challenges in the classroom having to provide socio-emotional and academical support. In her book *Culturally Responsive Teaching and The Brain* Hammonds (2015) explained that part of the solution for nowadays challenges in the classroom is based on the research that neuroscientists have done about brain functioning and how this knowledge provides teachers with tools to support ESL and culturally and linguistically diverse (CLD) students to go from dependent learners to independent learners, by building their intellective capacity and helping them feel more socially and emotionally connected to school and learning. Hammonds (2015) also asserted that it is possible to help students increase their brainpower by offering them sufficient opportunities in the classroom to develop the cognitive skills and habits of mind that would prepare them to take on more advanced academic tasks.

As Wilson and Conyers (2016) mentioned in their book *Teaching Students to Drive Their Brains*, curiosity is an element that advertisers and online content providers use to grab people’s attention and motivate them to make decisions such as purchasing an item. If curiosity has such an amazing influence, it would be wonderful for teachers to use it in order introduce lessons in interesting ways that can make the most out of students’ selective attention and working memory

(p. 1104). Mora (2013) also explained that learning, memory, attention, and curiosity are consequence of emotions. Therefore, students' emotions can lead them to succeed or fail in their academic expectations. Positive moods and motivation produce broader attention, more creative and holistic thinking (Seligman, 2011, p. 80). It is important for teachers to know what strategies they can apply in the classroom and what strategies can be taught to students for them to be able to become more optimistic about their learning and more resilient when facing challenges. According to Wilson and Conyers (2016) neuroscientific studies have indicated that with time students can learn to direct their attention to make the most out of the working memory and can show progress in their academic performance by enhancing their ability to identify, focus on, and select the most important information among all inputs (p. 1084). Consequently, Guillen (2017) stated that by teaching students to have more control over their emotions, attention, and memory students are more likely to regulate the cognitive and behavioral processes necessary to plan and make decisions (p. 13).

Emotions propel curiosity and attention, elements that are essential to facilitate the processes of memorization and learning (Guillen, 2017, p. 13). The prevalent emotions in a classroom learning environment influence students' attention to learning (Szpunar et al. 2013) According to Damasio (1994), neuroscience has shown that emotions maintain curiosity, help humans to communicate and are essential in reasoning and decision-making processes, this means, emotional and cognitive processes are attached. For this reason, it is imperative for teachers to know and learn about particular functions of the brain that represent an opportunity to transform the classroom environment and their teaching practices to have a positive impact in students' learning.

Conclusion.

Teachers have the powers to change the world one child at a time, but what if they incorporate neuroeducation theories and strategies to support students emotional and academical processes? The human brain is extremely flexible. It is able to adapt its activity and change its structure significantly throughout life, although it is more efficient in the first years of development [sensitive periods for learning] (Guillen, 2017). Experience modifies the brain continuously by strengthening or weakening the synapses that connect neurons, thus generating learning that is favored by the neuronal regeneration process called neurogenesis. From an educational perspective, this brain plasticity is transcendental because it makes it possible for any student to improve and, specifically, it can act as a compensatory mechanism in learning disorders such as dyslexia and ADHD.

The product of this project is a website that provides accurate information and tools for ESL elementary teachers to implement strategies based on neuroeducation to support students emotional and academic processes. These strategies are provided not only by neuroscience but also psychology and pedagogy. The aim of these strategies is to teach students and teachers how the brain is wired for growth and how they from their different roles can work the brain to have more control over their teacher and learning.

In the website teachers will find first, information to learn and understand the brain's structure and function from an educational perspective. How emotions, attention, memory and others such as creativity, cooperation, interaction through game, nature and motion play an important role in learning. And second, resources to apply different strategies from each of the main components of this project (neuroscience, pedagogy, and psychology).

Chapter 4: The Project

As Jesus Guillen (2017) asserted, neuroeducation offers teachers the opportunity to know about the executive functions of the brain and the impact of emotions in the learning process. Following the idea of getting to know more about brain functioning to support students in the classroom, the product of this project is a website intended to provide strategies and resources in the form of anchor charts, posters, videos, and blogs based on the advances in neuroeducation to support ESL teachers. In this chapter, the organization and content of the website will be described in detail as well as the purpose of the material. This digital tool was designed with the WIX website builder and can be accessed at the URL https://jennifergarcia773.wixsite.com/the-power-of-science

Homepage and Main Menu

After accessing the URL users will be able to visualize the first section of the website and five different tabs that will allow them to navigate through the resources designed and focused on each of the three components of the project (Figure 4.1). The home screen shows a logo at the top that reads neuroeducation the power of learning. Underneath the title and the website's logo users will find the five different tabs that have the following order home, Neuroscience, Pedagogy, keep exploring, And contact. In each tab, users will be able to access the material which will be automatically downloaded to their devices in PDF format.

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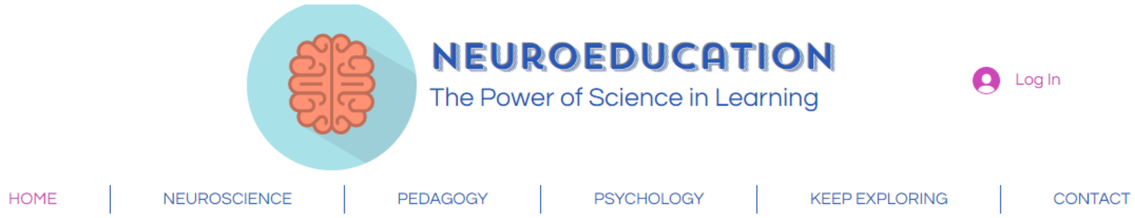


Figure 4.1: Home Page

As users continue to scroll down, they will find the title learning and the brain and a graphic illustration showing the integrated approach proposed by Jesus Guillen in 2017 (Figure 4.2). This part of the website offers a brief, but complete overview of what users will find in the different sections. The expectation when users get to this part of the website is for them to understand the meaning of each of the items that are in it. In this sense, the diverse needs of students are represented by colored pencils, all in different colors, sizes, and conditions. The graphic illustration shows the different disciplines that converge to be part of a new discipline called neuroeducation. The short description in each of the colored-component allows users to have an idea of how each discipline contributes to neuroeducation.

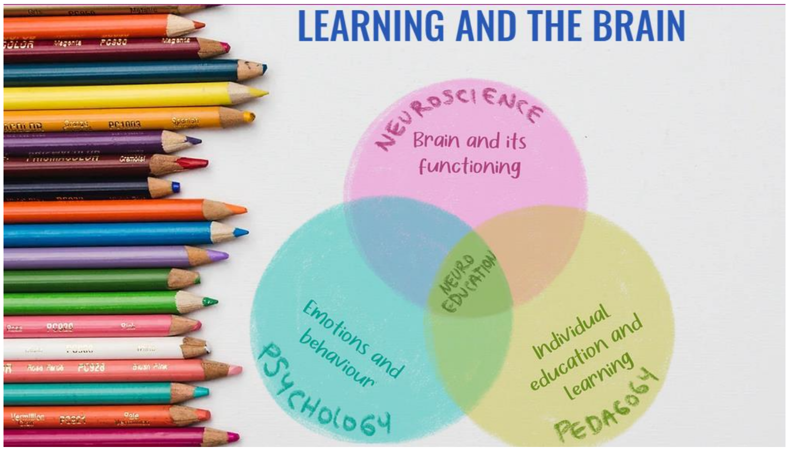


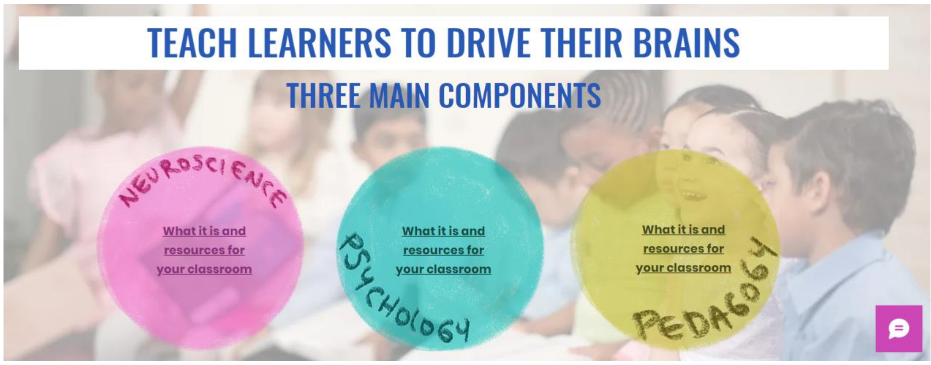
Figure 4.2: The Three Components

Below the graphic illustration, there is a quotation from Francisco Mora (2018) that seeks to invite and empower teachers to learn about brain functions to be better prepared to support their students (figure 4.3).

"Trying to teach content without knowing how the brain works is like designing a glove without seeing a hand before" Francisco Mora (2018)

Figure 4.3: Learn the Brain to Teach with Knowledge

Underneath, users will see a new title that reads *Teach Students to Drive Their Brains* named after Wilson and Conyers' (2016) book. And below it hyperlinks are placed in three different colored-circles that contain the names of the three components of this project (figure 4.4). By clicking on the links users will be able to navigate through the different parts of the website, but they can also click on the tabs at the top of the main menu to access the content.



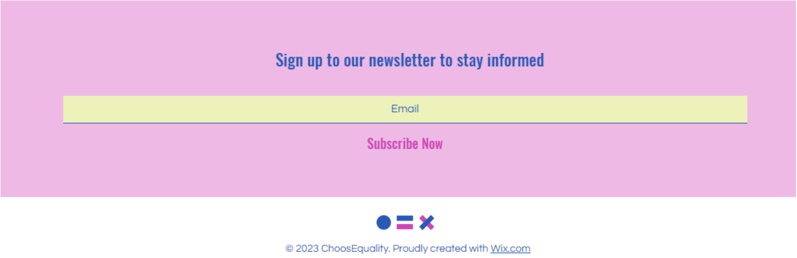
TEACH LEARNERS TO DRIVE THEIR BRAINS

THREE MAIN COMPONENTS

NEUROSCIENCE
What it is and resources for your classroom
PSYCHOLOGY
What it is and resources for your classroom
PEDAGOGY
What it is and resources for your classroom

Figure 4.4: Neuroscience, Psychology, and Pedagogy

At the bottom of the home page, users can also sign up to receive a newsletter to stay informed of new uploads. Moreover, there is a box where users are encouraged to provide their additional questions, feedback, and suggestions (Figure. 4.5).



Sign up to our newsletter to stay informed

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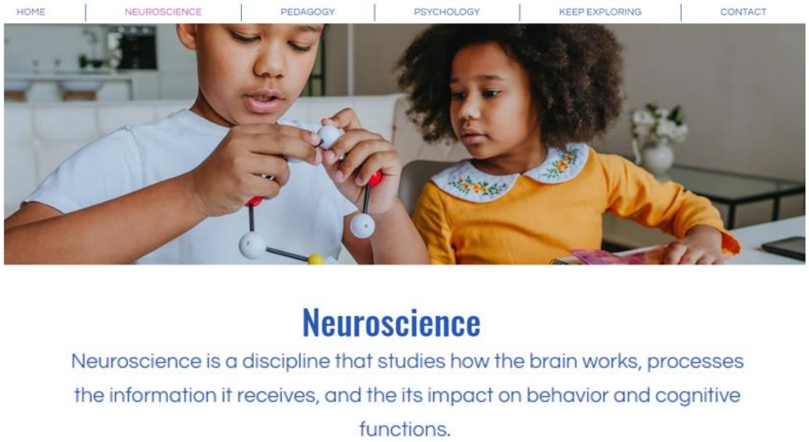
Figure 4.5: Stay Tuned

The Three Components.

As mentioned before this project has its basis on three components. Neuroscience is the first component to discover, and users will be able to access the content of this tab by clicking on the second tab of the main menu from left to right. The neuroscience tab will take users to a different screen where they will see a picture of two children playing and discovering how neurons communicate (Figure 4.6). Underneath this picture users will find a brief definition of what neuroscience is and images with hyperlinks that will take them to different anchor charts in PDF format. Each anchor chart provides instructions on how to use the resources, what additional material is needed, tips, and the purpose of it the activity.



Neuroscience

Neuroscience is a discipline that studies how the brain works, processes the information it receives, and the its impact on behavior and cognitive functions.

Figure 4.6: Neuroscience

By scrolling down users will be able to see the name of the five different resources that have been created having in mind neuroscientific content that teachers can work with their students. The name and illustration of each of the five different resources provide users a clear idea of the content of the resource (Figure 4.7).

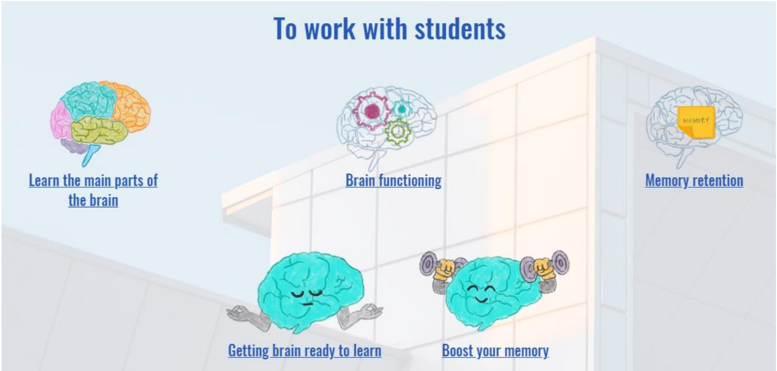
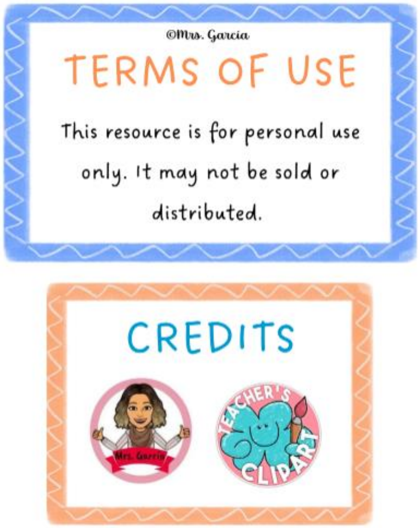


Figure 4.7: Neuroscience Anchor Charts

By clicking on the title of each of the resources, users will automatically download the material, followed by instructions for use that are also attached in the PDF document. The first page of each anchor chart includes a description of the terms of use of the material and the credits (4.8). And the second-page users will find a brief description of the resource, additional material needed, procedures, tips, and the purpose of each activity (Figure 4.9).



©Mrs. Garcia

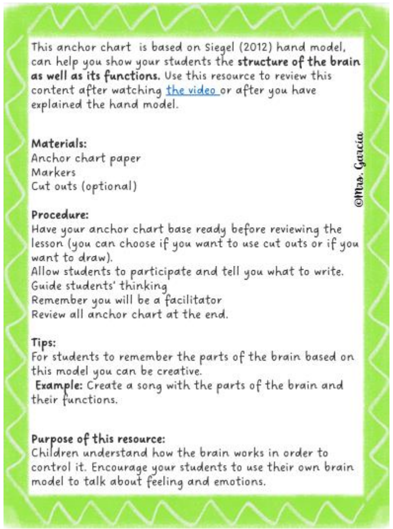
TERMS OF USE

This resource is for personal use only. It may not be sold or distributed.

CREDITS

Mrs. Garcia
TEACHER'S CLIPART

4.8 Terms of Use and Credits



This anchor chart is based on Siegel (2012) hand model, can help you show your students the **structure of the brain as well as its functions.** Use this resource to review this content after watching the video or after you have explained the hand model.

Materials:
Anchor chart paper
Markers
Cut outs (optional)

Procedure:
Have your anchor chart base ready before reviewing the lesson (you can choose if you want to use cut outs or if you want to draw).
Allow students to participate and tell you what to write.
Guide students' thinking
Remember you will be a facilitator
Review all anchor chart at the end.

Tips:
For students to remember the parts of the brain based on this model you can be creative.
Example: Create a song with the parts of the brain and their functions.

Purpose of this resource:
Children understand how the brain works in order to control it. Encourage your students to use their own brain model to talk about feeling and emotions.

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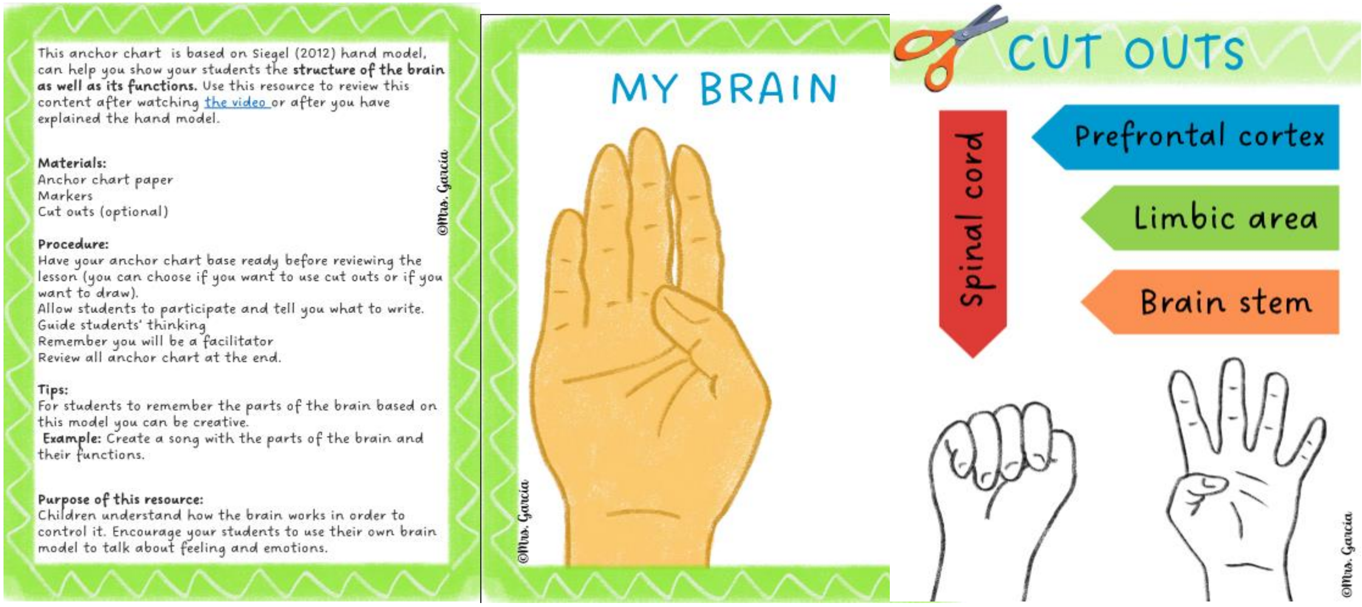
4.9 Directions

The first anchor chart is under the name my brain and it opens after clicking on the title learn the main parts of the brain. It is based on Daniel Siegel's (2011) hand model. It shows students the structure of the brain as well as its functions. It also includes cutouts with the names of the parts for students to help place them on the right spot, this can make the anchor chart activity interactive as students participate in the creation of it (Figure 4.10). Additional to the printable material there is a link to a video by Dr. Daniel Siegel in which he presents the hand model of the brain which allows for better understanding prior to bringing this lesson to the classroom.



This anchor chart is based on Siegel (2012) hand model, can help you show your students the **structure of the brain as well as its functions.** Use this resource to review this content after watching the video or after you have explained the hand model.

Materials:
Anchor chart paper
Markers
Cut outs (optional)

Procedure:
Have your anchor chart base ready before reviewing the lesson (you can choose if you want to use cut outs or if you want to draw).
Allow students to participate and tell you what to write.
Guide students' thinking
Remember you will be a facilitator
Review all anchor chart at the end.

Tips:
For students to remember the parts of the brain based on this model you can be creative.
Example: Create a song with the parts of the brain and their functions.

Purpose of this resource:
Children understand how the brain works in order to control it. Encourage your students to use their own brain model to talk about feeling and emotions.

Figure 4.10: Main Parts of the Brain

The title of the second anchor chart is where I am now, and users can access it after clicking the brain function button. This anchor chart is inspired by the book *The whole Brain child* by Daniel Siegel from 2012 In this resource teachers will find cutouts to work with students sorting the skills and attitudes that go upstairs and downstairs. On the second page, there are also name tags for students to label with their names and place on the anchor chart to indicate where they are (Figure 4.11). This resource can help students define their mental stages based on their behavior and class work during any instructional time.

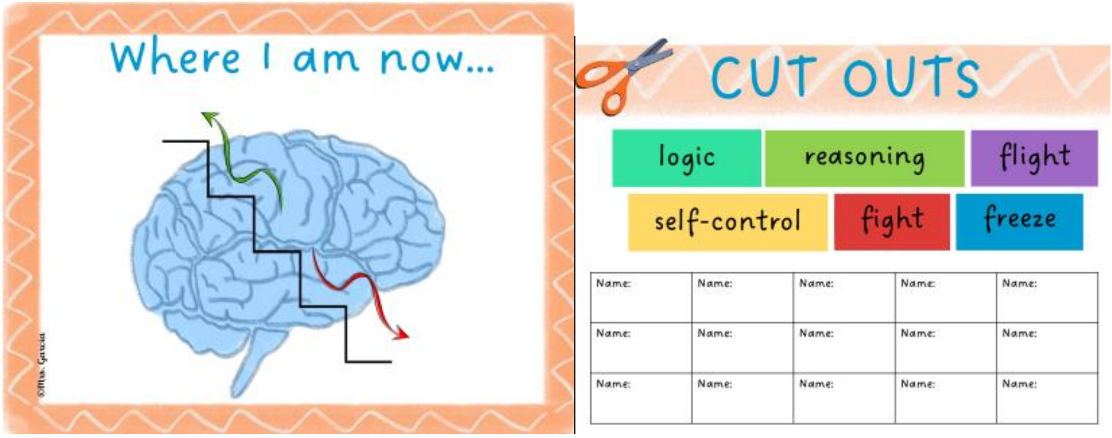


Figure 4.11: Brain Functioning

The third anchor chart summarizes the theory of memory proposed by Richard Atkinson and Richard Shiffrin in 1968. This resource can be used to help students enhance their self-reflection about their memory retention. It includes cutouts to engage in the creation of the anchor chart (Figure. 4.12). Teachers are encouraged to laminate the poster and use Velcro dots to be able to use the cutouts multiple times. In order to help students use this resource to track their memory retention teachers can use post-it strips with students' names and ask them to place it in the part of the chart that shows how much they remember a specific topic. This chart can also provide teachers with feedback to know if a topic needs to be reviewed.

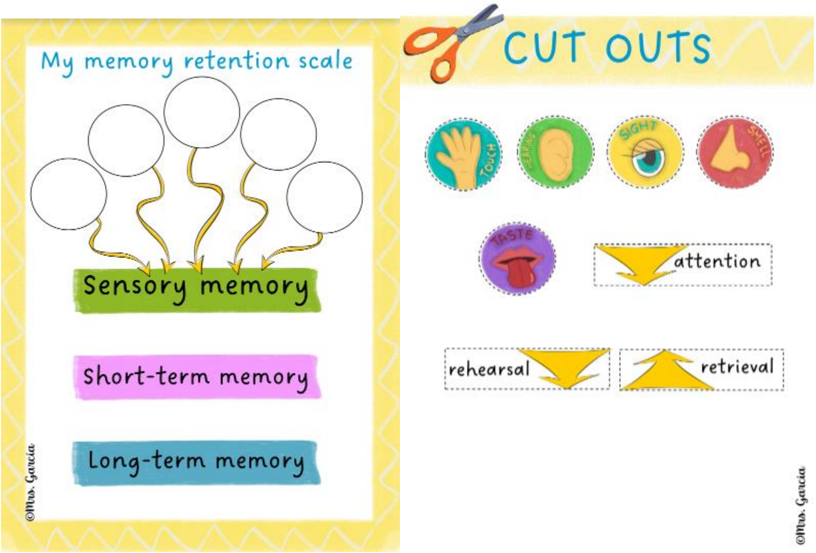


Figure 4.12: Memory Retention

The fourth anchor chart of this section has the title ready to learn? And users can access it by clicking the getting brain ready to learn button. This is also an interactive anchor chart that seeks to help students realize what their brain needs to be ready to start a learning day. In the PDF document, there are included six cutouts that represent a checklist for students to self-assess their readiness to learn (Figure (4.13).

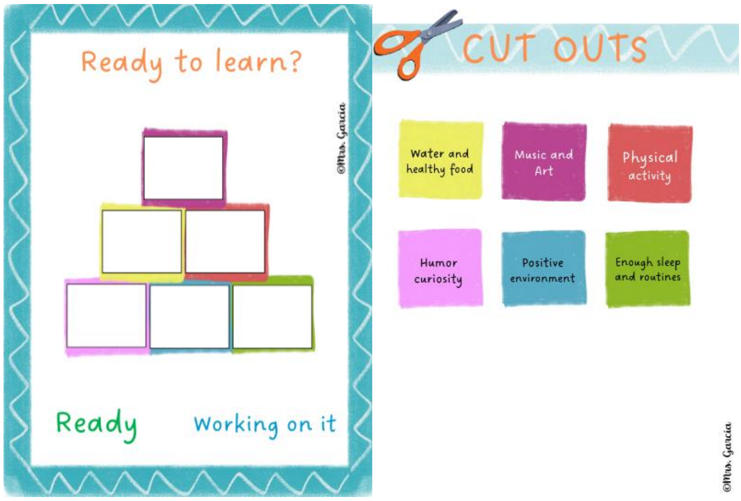


Figure 4.13 Getting Brain Ready to Learn

In the fifth and last anchor chart of the neuroscience section, there is a poster with strategies to exercise memory (Figure. 4.14). Teachers are encouraged to laminate the main poster with the title exercise your brain and use the cutouts to help students remember what strategies they can use to increase their retention.

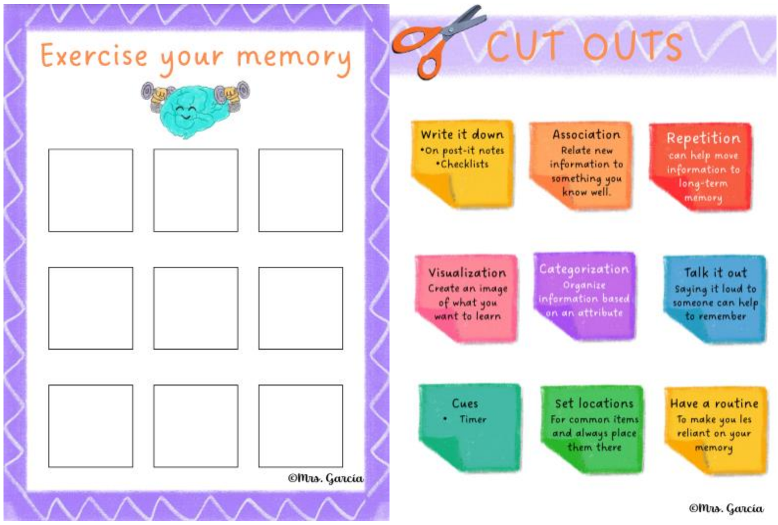

Exercise your memory
©Mrs. Garcia
CUT OUTS
Write it down
•On post-it notes
•Checklists
Association
Relate new information to something you know well.
Repetition
can help move information to long-term memory
Visualization
Create an image of what you want to learn
Categorization
Organize information based on an attribute
Talk it out
Saying it loud to someone can help to remember
Cues
• Timer
Set locations
For common items and always place them there
Have a routine
To make you les reliant on your memory
©Mrs. Garcia

Figure 4.14 Boost Your Memory

The second component to explore is Pedagogy (See Figure 4.15). At the top of this section, users will be able to see a big title with the name of the section and a short description of what this discipline studies.

PEDAGOGY

Discipline dedicated to learning and educational processes. Establishes objectives and how to achieve them.

Figure 4.15: Pedagogy

By scrolling down users can access four illustrations that represent the metacognitive strategies that can be used to increase the effectiveness of a lesson in an ESL classroom (Figure 4.16). By clicking on each of the names of the illustrations, users will find anchor charts related to the use of metacognition to potentialize their instructional practice.

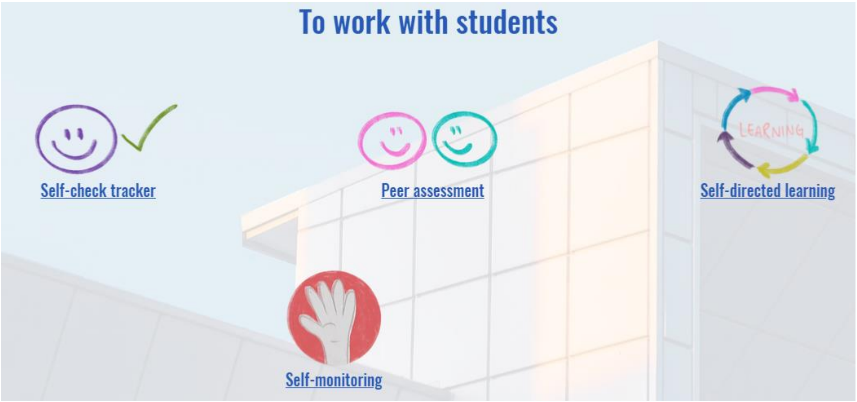
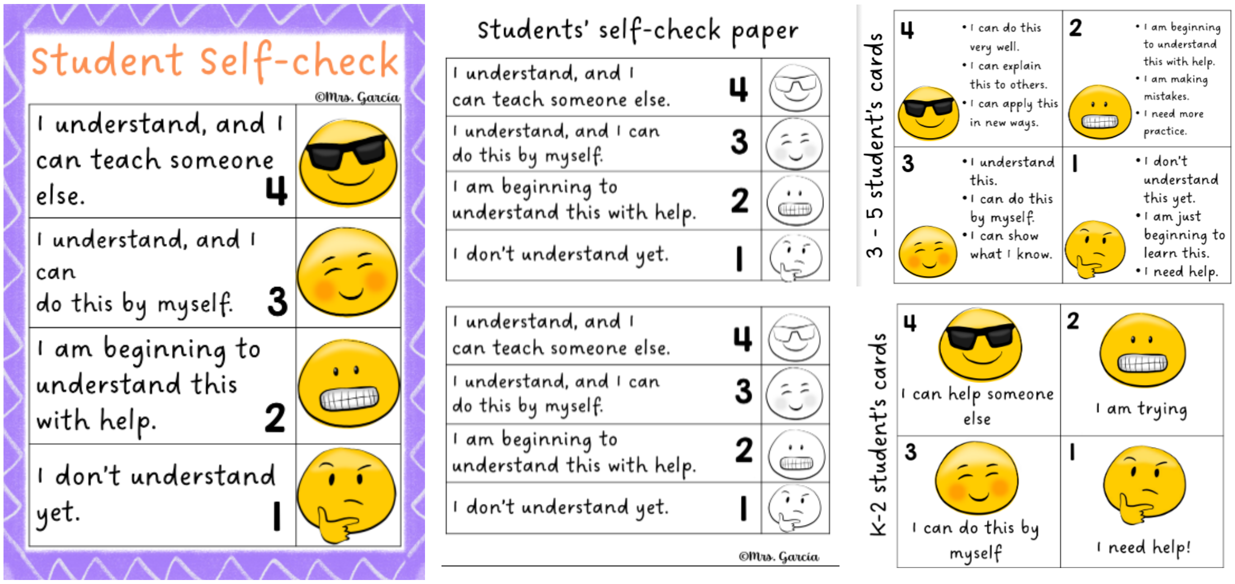


Figure 4.16 Pedagogy Anchor Charts

The first two anchor charts of this section are a self-check tracker and a peer assessment (See figures 4.17 and 4.18). By using these two assessment anchor charts, users are building a safe and positive environment where mistakes are accepted as feedback for future practices. Users can print the anchor charts or project them on a screen to model students how to use them. The student self-check anchor chart also includes description cards to differentiate instructions for students in kindergarten to second grade from third grade to fifth grade.



Student Self-check

©Mrs. Garcia

I understand, and I can teach someone else.	4
I understand, and I can do this by myself.	3
I am beginning to understand this with help.	2
I don't understand yet.	1

Students' self-check paper

I understand, and I can teach someone else.	4
I understand, and I can do this by myself.	3
I am beginning to understand this with help.	2
I don't understand yet.	1

I understand, and I can teach someone else.	4
I understand, and I can do this by myself.	3
I am beginning to understand this with help.	2
I don't understand yet.	1

©Mrs. Garcia

3 - 5 student's cards

4
- I can do this very well.
- I can explain this to others.
- I can apply this in new ways.

2
- I am beginning to understand this with help.
- I am making mistakes.
- I need more practice.

3
- I understand this.
- I can do this by myself.
- I can show what I know.

1
- I don't understand this yet.
- I am just beginning to learn this.
- I need help.

K-2 student's cards

4 I can help someone else

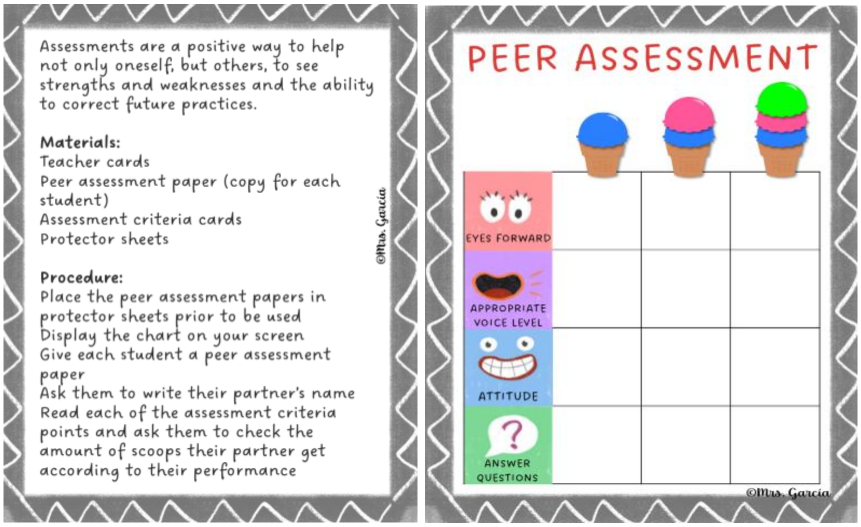
2 I am trying

3 I can do this by myself

1 I need help!

Figure 4.17: Self-Check Tracker

When working with the peer assessment anchor chart users are encouraged to print a copy for each student and place it in a protector sheet. This allows students to use them multiple times.



Assessments are a positive way to help not only oneself, but others, to see strengths and weaknesses and the ability to correct future practices.

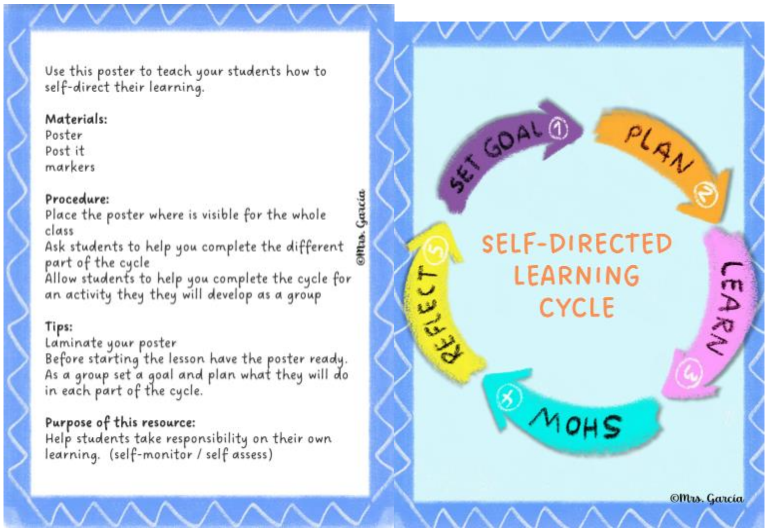
Materials:
Teacher cards
Peer assessment paper (copy for each student)
Assessment criteria cards
Protector sheets

Procedure:
Place the peer assessment papers in protector sheets prior to be used
Display the chart on your screen
Give each student a peer assessment paper
Ask them to write their partner's name
Read each of the assessment criteria points and ask them to check the amount of scoops their partner get according to their performance

©Mrs. Garcia

Figure 4.18: Peer Assessment

The self-directed link will take users to a poster that students will be able to see to successfully direct their own learning. In the same document, users will find instructions on how to use it in the classroom as well as additional recommendations to make this a useful tool to guide students learning (Figure 4.19).



Use this poster to teach your students how to self-direct their learning.

Materials:
Poster
Post it
markers

Procedure:
Place the poster where is visible for the whole class
Ask students to help you complete the different part of the cycle
Allow students to help you complete the cycle for an activity they they will develop as a group

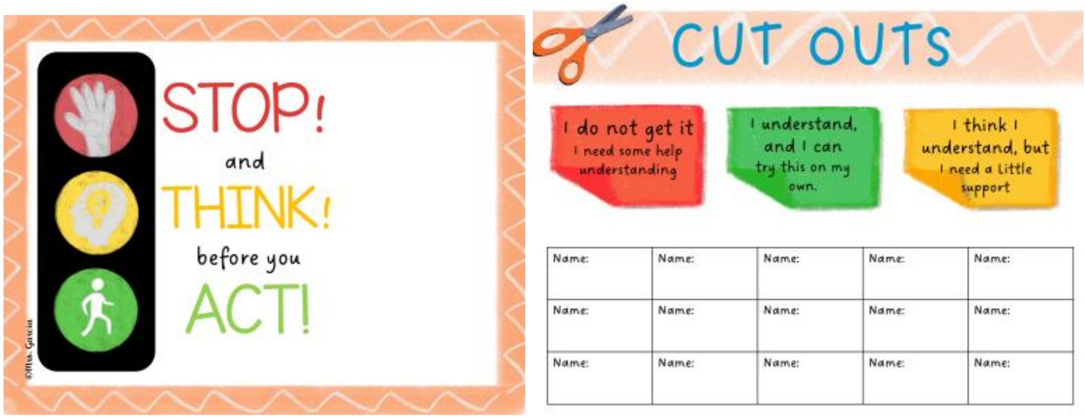
Tips:
Laminate your poster
Before starting the lesson have the poster ready.
As a group set a goal and plan what they will do in each part of the cycle.

Purpose of this resource:
Help students take responsibility on their own learning. (self-monitor / self assess)

©Mrs. Garcia

Figure 4.19: Self-Directed Learning

The last resource in the pedagogy section is a poster under the name self-monitoring (Figure 4.20). Users can use this resource to help students learn to identify whether or not they have understood a topic or if they need help. The first part of the material has a traffic light with three lights showing the three optional answers. The last part of the resource has the description of each of the lights and students are expected to remember with time each of these descriptions in order to determine if they have understood or need to reinforce. Additional to the descriptions there is a chart with labels for students to trace their names and place them on the part of the traffic light they feel they are at. This will be also a tool for users to identify when someone needs extra support.


STOP!
and
THINK!
before you
ACT!
©Mrs. Garcia
CUT OUTS
I do not get it
I need some help understanding
I understand, and I can try this on my own.
I think I understand, but I need a little support

Name:	Name:	Name:	Name:	Name:
Name:	Name:	Name:	Name:	Name:
Name:	Name:	Name:	Name:	Name:

Figure 4.20: Self-Monitoring

The next section to explore is the third component of this project, psychology. Users will be able to access this section by clicking on the psychology option in the navigation bar. Once they click a new window will open showing at the top the title psychology and a brief description (Figure 4.21).

PSYCHOLOGY

Discipline dedicated to learning and educational processes. Establishes objectives and how to achieve them.

Figure 4.21: Psychology

As users continue to scroll down this section, they will be able to see five illustrations, each with a title indicating the name of the anchor chart or poster (Figure 4.22). Activities in this section have been designed thinking on how to apply psychological science to improve the learning process and promote educational success for all students.

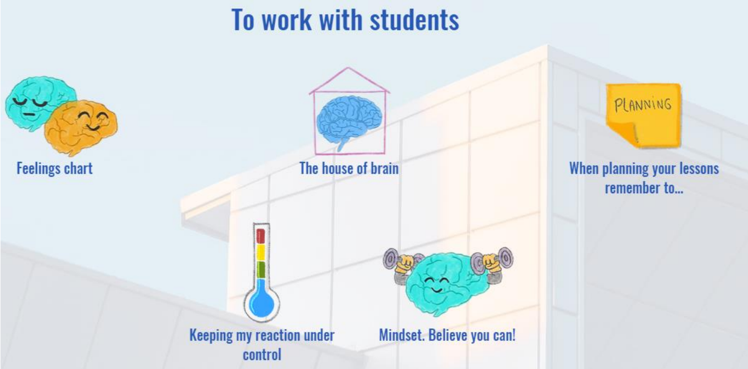
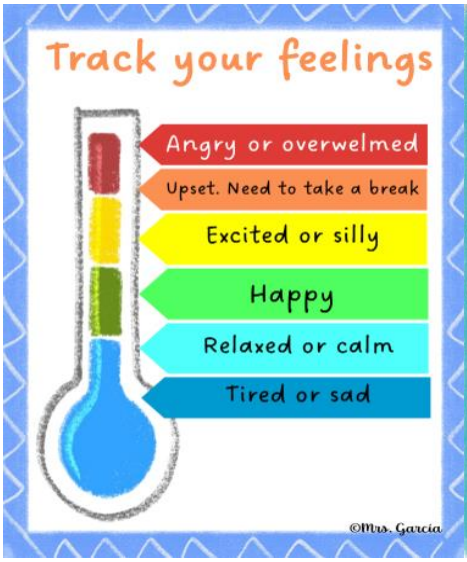

To work with students
Feelings chart
The house of brain
PLANNING
When planning your lessons remember to...
Keeping my reaction under control
Mindset. Believe you can!

Figure 4.22: Psychology Anchor Charts

The first resource of the psychology section is an anchor chart under the name the feelings chart (Figure 4.23). Understanding emotions are crucial when learning a second language. This poster is an appealing and useful resource that helps users to make emotions visible in the classroom, especially when kids are not willing to talk about them in a spontaneous way. This resource is inspired by the book *The Whole Brainchild* by Dr. Dan Siegel (2012). In the same way, users can visualize another resource with the title keeping my emotions under control (Figure 4.24). Once they click on it, they will be able to see an anchor chart that can help students learn to identify small problems vs. big problems and provides simple alternatives to solve them. This tool also allows students to be aware of their emotions and reactions and keep track of them.



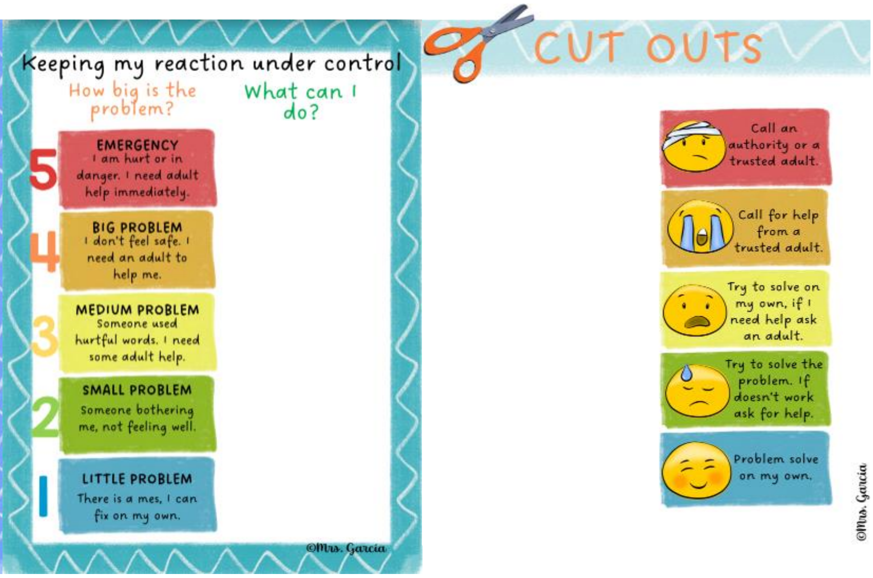

Keeping my reaction under control
How big is the problem?
What can I do?
5
EMERGENCY
I am hurt or in danger. I need adult help immediately.
4
BIG PROBLEM
I don't feel safe. I need an adult to help me.
3
MEDIUM PROBLEM
Someone used hurtful words. I need some adult help.
2
SMALL PROBLEM
Someone bothering me, not feeling well.
1
LITTLE PROBLEM
There is a mes, I can fix on my own.
©Mrs. Garcia
CUT OUTS
Call an authority or a trusted adult.
Call for help from a trusted adult.
Try to solve on my own, if I need help ask an adult.
Try to solve the problem. If doesn't work ask for help.
Problem solve on my own.
©Mrs. Garcia

Figure 4.23: Feelings Chart **Figure 4.24: Keeping my Emotion Under Control**

The next resource is the house of the brain also inspired based on Dr. Dan Siegel and Dr. Tina Payne Bryson's book *The Whole-Brain Child*. This anchor chart can help students understand the location of the brain's basic functions in the downstairs area and more complex functions such as critical thinking and planning in the upstairs area. By using this resource users can be more aware of their students' emotional status before starting a lesson and provide support if needed. This wonderful tool also allows students and teachers to build a bond as students feel that someone cares about how they feel (Figure. 4.25).

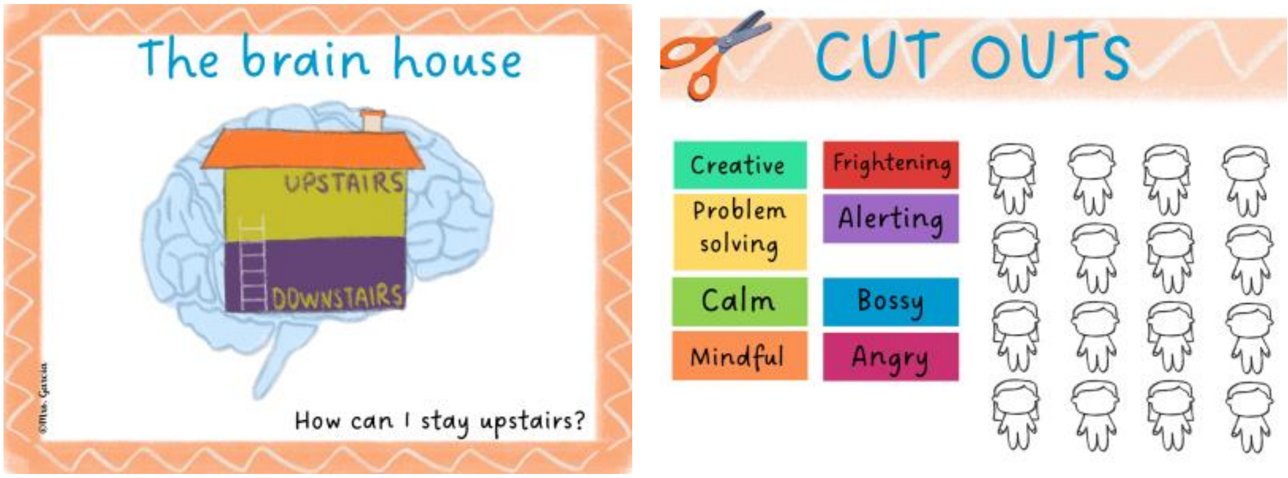
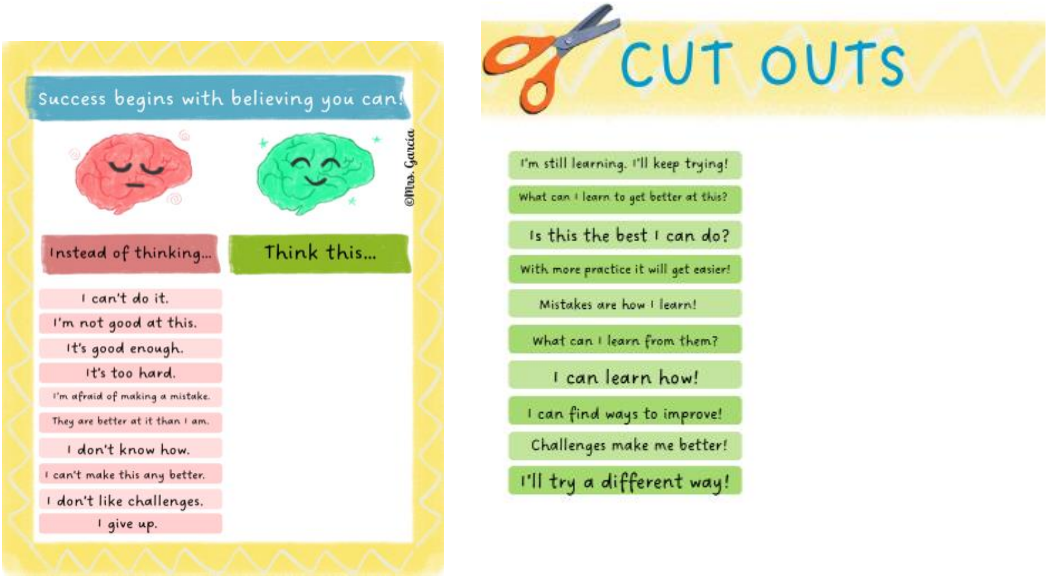


Figure 4.25: House of Brain

Following the next resource in this section, users can click on the title mindset believe you can! After clicking on this a PDF document will be downloaded containing an anchor chart in which students will find negative statements that they are expected to switch to a positive statement (Figure. 4.26). Emotions can be an important ally when acquiring a second language but if students do not know how to control their feelings these can lead to unsuccessful endings. This resource can motivate students to adopt a growth mindset to be more successful at school.



Success begins with believing you can!

Instead of thinking...
I can't do it.
I'm not good at this.
It's good enough.
It's too hard.
I'm afraid of making a mistake.
They are better at it than I am.
I don't know how.
I can't make this any better.
I don't like challenges.
I give up.

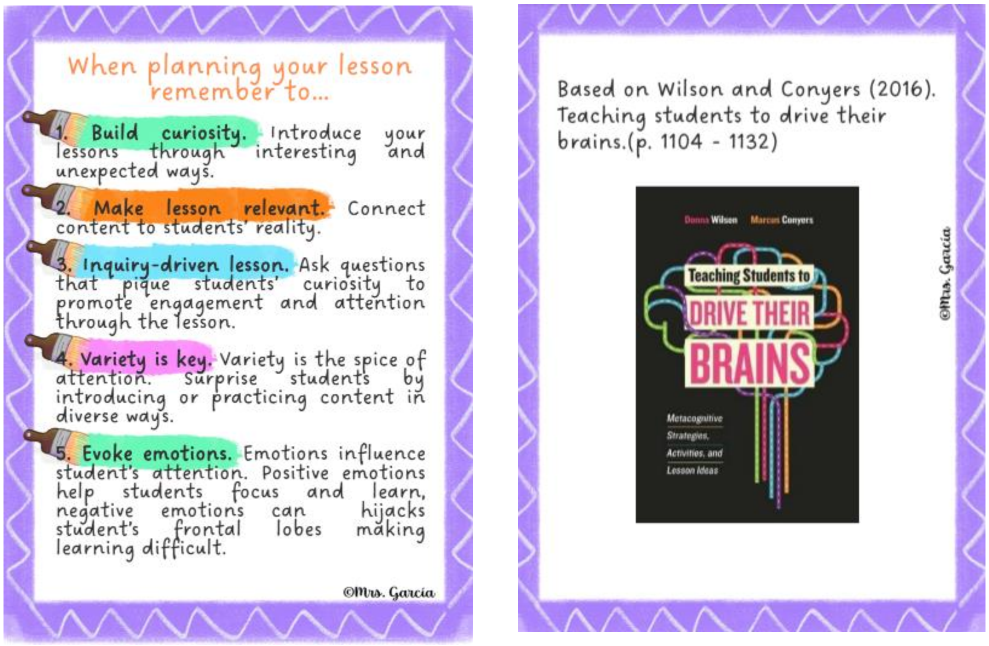
Think this...

CUT OUTS

I'm still learning. I'll keep trying!
What can I learn to get better at this?
Is this the best I can do?
With more practice it will get easier!
Mistakes are how I learn!
What can I learn from them?
I can learn how!
I can find ways to improve!
Challenges make me better!
I'll try a different way!

Figure 4.26: Mindset Believe You Can

As users continue to explore the psychology section, they will find the last resource of this section with the title when planning your lessons remember to. By clicking on the title users will have access to a poster that offers five tips for educators to consider when designing their instruction (Figure. 4.27). These five tips are based on Wilson and Conyers's (2016) book *Teaching students to drive their brains.*



When planning your lesson remember to...

1. **Build curiosity.** Introduce your lessons through interesting and unexpected ways.
2. **Make lesson relevant.** Connect content to students' reality.
3. **Inquiry-driven lesson.** Ask questions that pique students' curiosity to promote engagement and attention through the lesson.
4. **Variety is key.** Variety is the spice of attention. Surprise students by introducing or practicing content in diverse ways.
5. **Evoke emotions.** Emotions influence student's attention. Positive emotions help students focus and learn, negative emotions can hijacks student's frontal lobes making learning difficult.

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Based on Wilson and Conyers (2016). Teaching students to drive their brains.(p. 1104 - 1132)

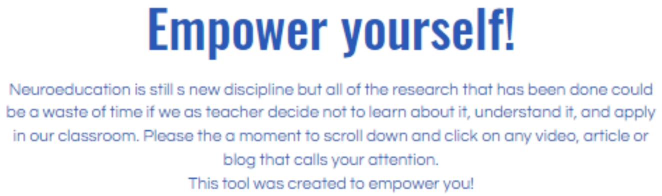
Donna Wilson Marcus Conyers
Teaching Students to
DRIVE THEIR
BRAINS
Metacognitive Strategies, Activities, and Lesson Ideas

©Mrs. Garcia

Figure 4.27: When Planning Your Lessons Remember To.

Keep Exploring

The keep exploring section is a part of the website where users will be able to find content in different formats such as videos, blogs, books, and articles to learn more about neuroeducation. At the top of this section, the user can see a big title that reads empower yourself and a brief description of the purpose of the different resources recommended by the creator of the website (Figure 4.28).

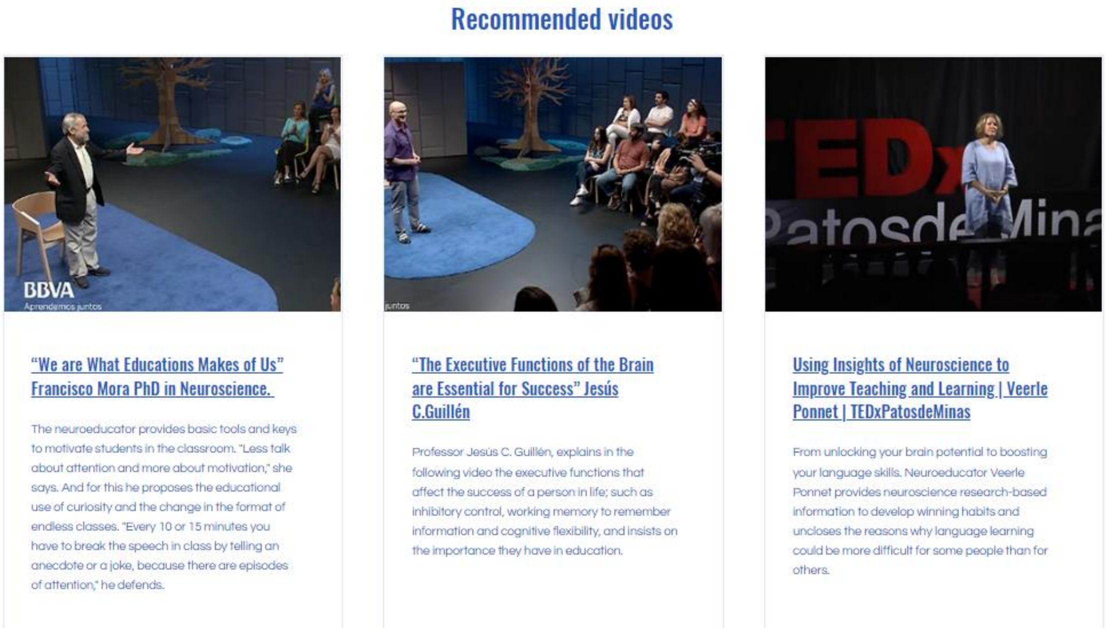


Empower yourself!

Neuroeducation is still s new discipline but all of the research that has been done could be a waste of time if we as teacher decide not to learn about it, understand it, and apply in our classroom. Please the a moment to scroll down and click on any video, article or blog that calls your attention.
This tool was created to empower you!

Figure 4.28: Empower Yourself

As users continue to explore this section, they will first find the recommended videos. There are twelve videos related to the different components of this project (Figure. 4.29). Each video has a short description so users can be able to determine if they want to watch them.



Recommended videos

“We are What Educations Makes of Us” Francisco Mora PhD in Neuroscience.

The neuroeducator provides basic tools and keys to motivate students in the classroom. "Less talk about attention and more about motivation," she says. And for this he proposes the educational use of curiosity and the change in the format of endless classes. "Every 10 or 15 minutes you have to break the speech in class by telling an anecdote or a joke, because there are episodes of attention," he defends.

“The Executive Functions of the Brain are Essential for Success” Jesús C.Guillén

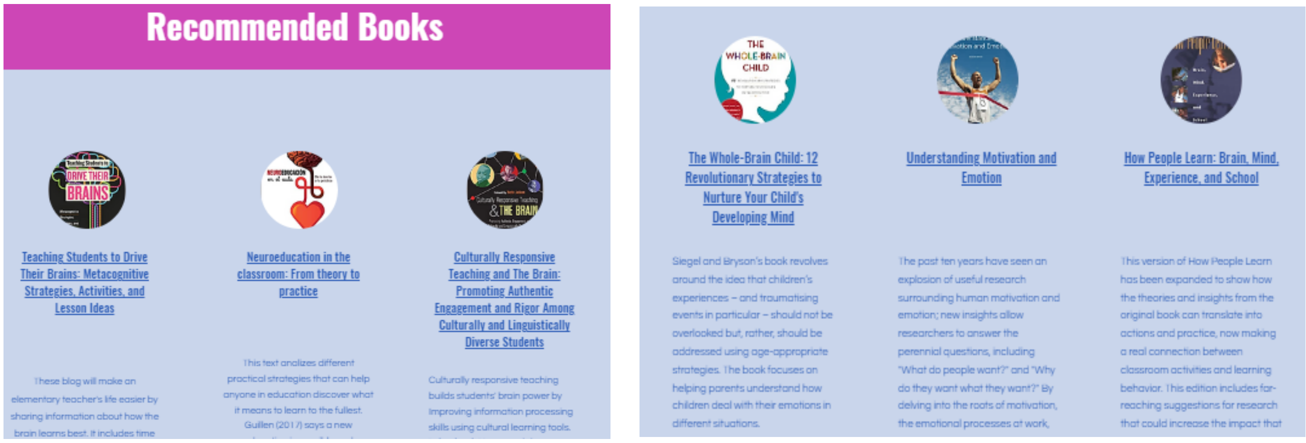
Professor Jesús C. Guillén, explains in the following video the executive functions that affect the success of a person in life; such as inhibitory control, working memory to remember information and cognitive flexibility, and insists on the importance they have in education.

Using Insights of Neuroscience to Improve Teaching and Learning | Veerle Ponnet | TEDxPatosdeMinas

From unlocking your brain potential to boosting your language skills. Neuroeducator Veerle Ponnet provides neuroscience research-based information to develop winning habits and uncloses the reasons why language learning could be more difficult for some people than for others.

Figure 4.29 Recommended Videos

In the same way, by scrolling down users will find recommended books with a brief summary of what users can find in each and get motivated to purchase them (Figure 4.30). Each of the book's content is related to the field of neuroeducation and offers users the opportunity to learn about this new discipline, plus strategies to take the theory to practice in the classroom. Additionally, at the bottom of this section users will find recommended articles and blogs (Figure 4.31). Also with a summary of the content that users will find when accessing them.



Recommended Books

Teaching Students to Drive Their Brains: Metacognitive Strategies, Activities, and Lesson Ideas

These blog will make an elementary teacher's life easier by sharing information about how the brain learns best. It includes time

Neuroeducation in the classroom: From theory to practice

This text analizes different practical strategies that can help anyone in education discover what it means to learn to the fullest. Guillen (2017) says a new

Culturally Responsive Teaching and The Brain: Promoting Authentic Engagement and Rigor Among Culturally and Linguistically Diverse Students

Culturally responsive teaching builds students' brain power by improving information processing skills using cultural learning tools.

The Whole-Brain Child: 12 Revolutionary Strategies to Nurture Your Child's Developing Mind

Siegel and Bryson's book revolves around the idea that children's experiences – and traumatising events in particular – should not be overlooked but, rather, should be addressed using age-appropriate strategies. The book focuses on helping parents understand how children deal with their emotions in different situations.

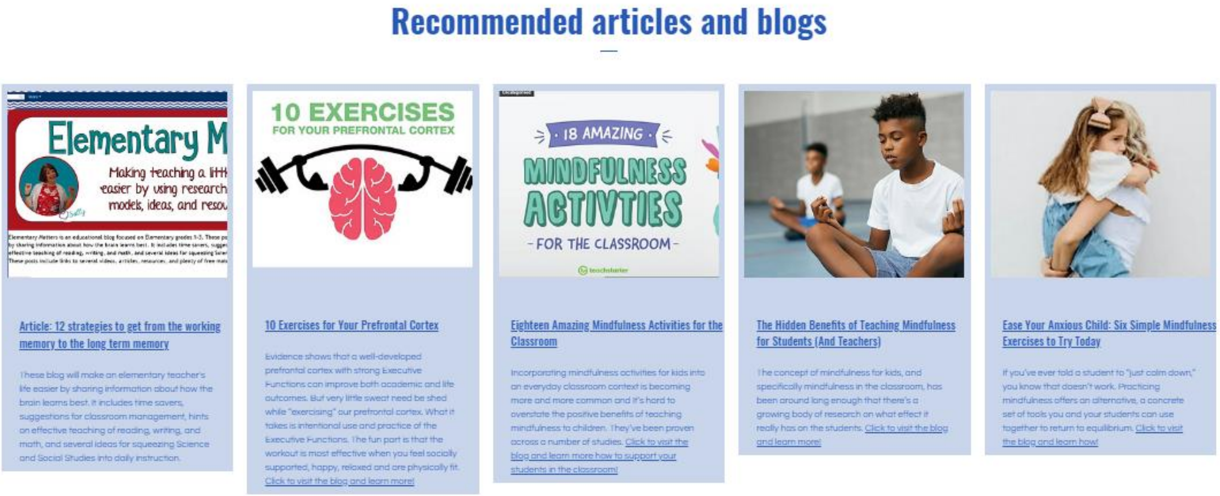
Understanding Motivation and Emotion

The past ten years have seen an explosion of useful research surrounding human motivation and emotion; new insights allow researchers to answer the perennial questions, including "What do people want?" and "Why do they want what they want?" By delving into the roots of motivation, the emotional processes at work,

How People Learn: Brain, Mind, Experience, and School

This version of How People Learn has been expanded to show how the theories and insights from the original book can translate into actions and practice, now making a real connection between classroom activities and learning behavior. This edition includes far-reaching suggestions for research that could increase the impact that

Figure 4.30: Recommended Books



Recommended articles and blogs

Article: 12 strategies to get from the working memory to the long term memory

These blog will make an elementary teacher's life easier by sharing information about how the brain learns best. It includes time savers, suggestions for classroom management, hints on effective teaching of reading, writing, and math, and several ideas for squeezing Science and Social Studies into daily instruction.

10 Exercises for Your Prefrontal Cortex

Evidence shows that a well-developed prefrontal cortex with strong Executive Functions can improve both academic and life outcomes. But very little sweat need be shed while "exercising" our prefrontal cortex. What it takes is intentional use and practice of the Executive Functions. The fun part is that the workout is most effective when you feel socially supported, happy, relaxed and are physically fit. Click to visit the blog and learn more!

Eighteen Amazing Mindfulness Activities for the Classroom

Incorporating mindfulness activities for kids into an everyday classroom context is becoming more and more common and it's hard to overstate the positive benefits of teaching mindfulness to children. They've been proven across a number of studies. Click to visit the blog and learn more how to support your students in the classroom!

The Hidden Benefits of Teaching Mindfulness for Students (And Teachers)

The concept of mindfulness for kids, and specifically mindfulness in the classroom, has been around long enough that there's a growing body of research on what effect it really has on the students. Click to visit the blog and learn more!

Ease Your Anxious Child: Six Simple Mindfulness Exercises to Try Today

If you've ever told a student to "just calm down," you know that doesn't work. Practicing mindfulness offers an alternative, a concrete set of tools you and your students can use together to return to equilibrium. Click to visit the blog and learn how!

Figure 4.31: Recommended Articles and Blogs

The list of articles, blogs, and videos recommended in the keep exploring section are listed below and they can be reached by clicking the hyperlink (See Figure 4.31). By reading and clicking on articles, blogs, videos, or books, users are encouraged to leave comments and rate the content of the website.

Article: 12 strategies to get from the working memory to the long-term memory

https://www.elementarymatters.com/2012/04/twelve-strategies-to-get-from-working.html

Ease Your Anxious Child: Six Simple Mindfulness Exercises to Try Today https://www.mother.ly/health-wellness/childrens-health/ease-your-anxious-child-6-simple-mindfulness-exercises-to-try-today/

Eighteen Amazing Mindfulness Activities for the Classroom

https://teacheraidecourseonline.com.au/2021/06/04/18-amazing-mindfulness-activities-for-the-classroom/

Good Thinking! — That's so Meta(cognitive)!

https://www.youtube.com/embed/f-4N7OxSMok

How can I help children develop their scientific thinking? | Michael Thomas

https://www.youtube.com/embed/2uK3d9hL-IQ

How to motivate yourself to change your behavior | Tali Sharot | TEDxCambridge

https://www.youtube.com/embed/xp0O2vi8DX4?t=33s

Teachers, know your brain! | Sandra van Aalderen | TEDxAmsterdamED

https://www.youtube.com/embed/Wz87r90Tf1I

Ten Exercises for Your Prefrontal Cortex

https://heartmindonline.org/resources/10-exercises-for-your-prefrontal-cortex

The Benefits of Emotional Intelligence for Our Children. Daniel Goleman

https://www.youtube.com/embed/NTYFjuAvR0Q

The Executive Functions of The Brain are Essential for Success by Jesus Guillen

https://www.youtube.com/embed/87W7RY4nzjE

The Hidden Benefits of Teaching Mindfulness for Students (And Teachers)

https://www.teachstarter.com/us/blog/teaching-mindfulness-improve-student-learning-us/

The Neuroscience of Learning | Bruce McCandliss

https://www.youtube.com/embed/5_6fezBz9IA

The Science of Thinking

https://www.youtube.com/embed/UBVV8pch1dM

Using Insights of Neuroscience to Improve Teaching and Learning by Veerle Ponnet

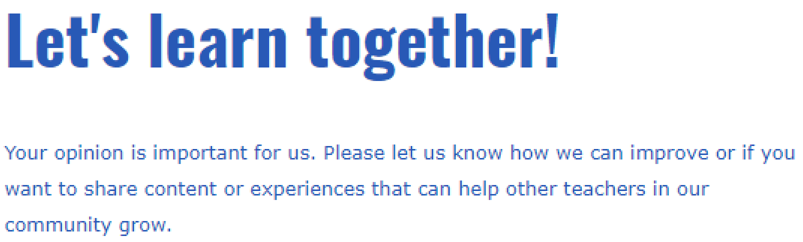
https://www.youtube.com/embed/NmAuawoYnUk?t=12s

What is Cognitive Neuroeducation? with Spencer M. Robinson, PhD

https://www.youtube.com/watch?v=61TKr6YRn6I&feature=youtu.be

Contact Section.

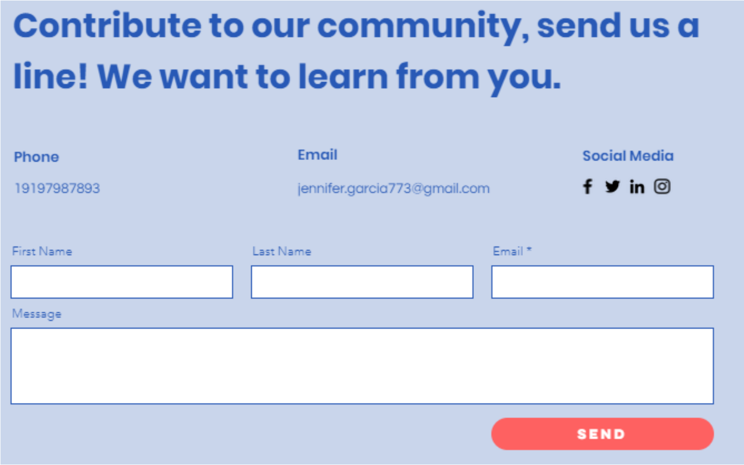
Moving to the last section of the website, users will be able to find the contact information site on the right side of the navigation bar. In this section, users are encouraged to leave comments, suggestions, or recommendations (See Figures 4.32 and 4.33). This can be a powerful tool to help teachers find solutions to the emotional, social, and physical needs of all ELLs and ensure they become life-long learners.



Let's learn together!

Your opinion is important for us. Please let us know how we can improve or if you want to share content or experiences that can help other teachers in our community grow.

Figure 4.32: Let's Learn Together



Contribute to our community, send us a line! We want to learn from you.

Phone

19197987893

Email

jennifer.garcia773@gmail.com

Figure 4.33: Contact Section

Chapter 5: Conclusion

Neuroeducation is a relatively new discipline that studies how the brain functions during the teaching-learning processes. This discipline analyzes the development of the human brain and its reaction to stimuli that could later be transformed into knowledge. As part of their job ESL teachers not only guide ELLs' language learning processes, but also support their social-emotional development. Neuroscientists such as Mora (2013) and Guillen (2017) have noted that the brain only learns if there is emotion. For this reason, introducing neuroeducation in the ESL elementary classrooms represents an opportunity to transform teaching practices and provide ESL teachers the knowledge about brain functioning that can help them to better support ELLs.

There are different keys to understanding why teachers, students, and society could benefit from teachers having foundational knowledge of neuroscience. Neuroscience has been using different technology and techniques, such as neuro-imaging to determine how the brain learns. However, who is going to interpret the information gathered from science, and who is going to make the correlation between the research and what it means in the classroom? Those tasks cannot take place in a laboratory, but teachers can collaborate with scientists to provide feedback between the scientific-based research provided and the result of the application of neuroscientific strategies and their accuracy, validity, and applicability in the actual classroom. In the same way, this partnership between neuroscience and education is an opportunity to see how the implications of new research can correlate with classroom instructional strategies, curriculum, planning, and school organization.

Based on the need to assist ESL teachers in the development of neuroscience skills and how to put them into practice in the ESL classroom, this project serves as a digital platform to encourage educators to apply three neuroscience principles recommended by different authors, such as Mora (2013) and Guillen (2017), who have found a correlation between three disciplines that converge in the process of learning (1) neuroscience, (2) pedagogy, and (3) psychology. This digital platform encompasses a set of anchor charts, posters, and materials to understand how by using each of these three components ESL teachers can support their students during instructional time. The digital platform also includes a list of recommended online articles, videos, and books to encourage teachers to build their own learning and take part in a community where they are invited to exchange opinions, ideas, and teaching experiences, and to provide positive feedback on the daily instruction.

Bringing the principles of neuroscience to the classroom is a challenge now more than ever since teachers are exhausted by all the requirements of this profession and having to face behavioral outbursts from students in the classroom. However, these challenges were also an inspiration for me, not only to build a must-have tool for teachers and to support their daily practices based on neuroscience research, but also as an opportunity to improve my social-emotional skills as a teacher. Through the process of researching and designing this project, I had the opportunity to apply neuroscientific strategies in my classroom and learned the importance of these strategies and the positive outcomes of integrating emotions in the second language acquisition classroom, and also which general metacognitive foundations to apply based on an understanding of brain functioning.

Finally, I envision this digital tool as the beginning of a journey in which teachers can grow as professionals by learning about neuroscience and applying this knowledge to benefit their community. My expectation is for teachers to use the material that has been designed to incorporate metacognitive strategies in their classroom and help students be more conscious about their learning, how to track their learning, and be in control of their learning.

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